REMARKS

Claims 1-20 are all the claims pending in the application. Claims 11-20 are withdrawn from consideration as being drawn to a non-elected invention. Claims 1-10 presently stand rejected.

Claims 1-3, 5 and 9 are objected to because of informalities. Applicant amends the claims to remove any ambiguities.

Claim 5 is rejected under 35 U.S.C. § 112, first paragraph. The Examiner asserts that the specification has only disclosed a polymer which does not always have no proton conductivity (see page 12, line 12).

However, in the present specification, it is specified that "it is not necessary that the porous polymer having ion-exchange function is provided for the small pores in the catalyst layer or/and the surface of its layer" (see page 10, lines 8-11). Therefore, Applicant respectfully submits that claim 5 is proper.

The Examiner questions that catalytic reaction at the electrode would not occur if a polymer with no proton conductivity is applied to the anode. Applicant respectively submits that the electrode in the present invention, as well as a conventional electrode, comprises not only a solid polymer electrolyte with proton conductivity but also catalyst particles in a catalyst layer (see claims 1 and 3). Accordingly, electrode reaction occurs. A place where a porous polymer is applied is in the pores and the surface of the catalyst layer, and the role of this polymer is to smoothly provide the gases, which is reactants, with a three-phase boundary by restraining accumulation of water in the pores and the surface of the catalyst layer. Therefor, the electrode becomes extremely highly activated (see page 10, lines 8-19).

Claims 2, 4 and 6 are rejected under 35 U.S.C. § 112, second paragraph. Applicant amends the claims to remove any ambiguities.

Claims 1-7, 9 and 10 are rejected under 35 U.S.C. § 102(b) as being anticipated by Mussell et al. (5,620,807).

Claim 8 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Mussell et al. (5,620,807) as applied to claims 1-7, 9 and 10.

Analysis

Claims 1 and 3 are the only claims in independent form; therefore, the following discussion is initially directed to these independent claims.

Claim 1 is directed to an electrode for a fuel cell. It includes a catalyst layer and a porous polymer. The catalyst layer contains a solid polymer electrolyte and catalyst particles. As shown in Fig. 4 for example, solid polymer electrolyte 42 is provided with catalyst particles 41. The porous polymer is represented by numeral 44. The porous polymer may include small pores 43 in the catalyst layer and/or at the surface of the catalyst layer.

Claim 3 is directed to a catalyst layer 71, a gas diffusion layer and a porous polymer 73. The catalyst layer 71 contains a solid polymer electrolyte and catalyst particles, and the gas diffusion layer contains an electro-conductive porous substrate 72.

The Examiner asserts that "Claims 1-7 and 10 are rejected under 35 U.S.C. § 102(b) as being anticipated by Mussell et al., US 5,620,807", and that "Mussell teaches a solid polymer electrolyte having a catalyst layer (1), a porous polymer (4), and gas diffusion layer (5)" (Col. 2

line 36 et seq.) However, Applicant respectfully submits that the Examiner's rejection is based on a misunderstanding of the prior art.

First, Mussell (Col. 2 line 35 et seq.) explains a membrane electrode assembly having a porous layer and flow field adjacent thereto in Fig. 1 (Col. 2 lines 23-24), and does not disclose "a solid polymer electrolyte" having a catalyst layer (1), a porous polymer (4), and gas diffusion layer (5). The alleged porous polymer (4) in Fig. 1 is a porous layer which is a layer of an electrically conductive porous material having at least two portions with different mean pore sizes (Col. 2 lines 40-42) and is not a porous polymer. That is, Mussell does not disclose that a porous polymer is applied to an electrode for a fuel cell.

Moreover, Raistrick (US 4,876,115) and Cabasso (5,783,325) also do not disclose that a porous polymer is applied to an electrode for fuel cell.

Accordingly, Applicant respectfully submits that claims 1 and 3 are patentable.

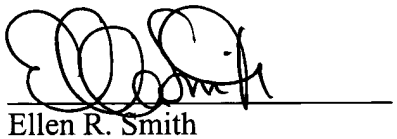
The remaining rejections are directed to the dependent claims. These claims are patentable for at least the same reasons as claims 1 and 3, by virtue of their dependency therefrom.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

Applicant hereby petitions for any extension of time which may be required to maintain the pendency of this case, and any required fee, except for the Issue Fee, for such extension is to be charged to Deposit Account No. 19-4880.

Respectfully submitted,



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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

The specification is changed as follows:

Page 17, paragraph 4:

A method of manufacturing the electrode for a fuel cell according to the present invention and structured as described above will now be described. Paste for the catalyst layer comprising catalyst supported on carbon particles, the solid polymer electrolyte solution and, if necessary, PTFE suspension is applied onto a polymer film to form a film of the paste (in general, having a thickness of 3 μm to 30 μm). Then, heating and drying are performed so that the conventional catalyst layer can be obtained. As an alternative to this, paste of the catalyst layer comprising catalyst supported on carbon particles (noble metal particles, such as platinum are highly dispersedly loaded on carbon particle) and, if necessary, PTFE suspension is applied onto the polymer film to form a film of the paste (in general, having a thickness of 3 μm to 30 μm). Then, heating and drying are performed. Then, the solid electrolyte solution is applied and allowed to be impregnated from a position above the [polymer] film of the paste. Thus, the conventional catalyst layer can be obtained. If necessary, these above-mentioned conventional catalyst layers are joined to the ion-exchange membrane. After that, if necessary, the gas diffusion layer including electro-conductive porous substrate is joined to the surface of the catalyst layer. Then, the solution (c) in which the polymer (a) is dissolved in the solvent (b) is contained in the above-mentioned conventional catalyst layer. Then, the polymer (a) is separated from the solution (c) by phase inversion process so that the catalyst layer including porous

polymer for a fuel cell's electrode is obtained. For example, catalyst layer including the solution [(C)] (c) is immersed into the non solvent (d) which is insoluble in polymer (a) and soluble in the solvent (b). Thus, the catalyst layer for a fuel cell's electrode can be obtained. Then, the polymer (a) is phase-separated from the solution (c) so that the electrode for a fuel cell is obtained by solvent extraction method. As an alternative to this, the solution (c) in which the polymer (a) is dissolved in the solvent (b) is contained by coating or immersion. Then, the non solvent (d) which is insoluble in polymer (a) and soluble in the solvent (b) is substituted for the polymer (a). Thus, the electrode for a fuel cell can be obtained by solvent extraction method.

Page 27, paragraph 3:

As can be understood from Fig. 1, the cells (A and B) according to the present invention exhibited higher output voltages at each current density as compared with the conventional cells C and D. In particular, the cell A structured such that porous PVdF was provided for the inside of the pores in the catalyst layer and the surface of the same exhibited an output higher than that of the cell B. Since the electrode according to the present invention has the structure that the porous PVdF exhibiting high hydrophobicity was provided for the inside portions of the pores in the catalyst layer and/or the surface of the same, supply of hydrogen and oxygen as reactants to the deep portions of the electrode was enabled. Therefore, an active area of the catalyst layer was larger than that of the conventional catalyst layer. In particular, the cell A' having the structure that porous PVdF was provided for the inside portions of the pores of the catalyst layer,

the surface of the same and inside of the carbon paper as the substrate, exhibited excellent characteristics.

IN THE CLAIMS:

The claims are amended as follows:

1. (Twice Amended) An electrode for a fuel cell comprising: a catalyst layer and a porous polymer, wherein said catalyst layer [containing] contains a solid polymer electrolyte and catalyst particles.

2. (Amended) The electrode according to claim 1, wherein said porous polymer is provided for [the] a [inside] portion of [porous] pores or/and surface of said catalyst layer.

3. (Amended) An electrode for a fuel cell comprising: a catalyst layer, [and] a gas diffusion layer and a porous polymer;

wherein said catalyst layer contains a solid polymer electrolyte and catalyst particles, and said gas diffusion layer [containing] contains an electro-conductive porous substrate.

4. (Amended) The electrode according to claim 3, wherein said porous polymer is provided for [the] a [inside] portion of pores or/and surface of said catalyst layer or/and an inside of the electro-conductive porous substrate.

5. (Amended) The electrode according to claim 1 or 3, [wherin] wherein said porous polymer has no ion-exchange function.

6. (Amended) The electrode according to claim 1 or 3, wherein pores of said porous polymer form [the] a three-dimensional network structure.

9. (Amended) The electrode according to claim 1 or 3, wherein a porosity of said porous polymer is within the range of 45% to 95%.

13. (Twice Amended) A method of manufacturing an electrode for a fuel cell comprising the steps of:

preparing an electrode (j) comprising a catalyst layer containing a solid polymer electrolyte and catalyst particles;

preparing a solution (c) in which a polymer (a) is dissolved in a solvent (b);

allowing said solution (c) to be contained in said electrode; and

[extracting said solvent (b) from the said solution (c) with a non solvent (d) which is insoluble in said polymer (a) and miscible with the solvent (b)] separating said polymer (a) from said solution (c).

14. (Amended) A method of manufacturing an electrode for a fuel cell comprising the steps of:

preparing an electrode (j) comprising a catalyst layer containing a solid polymer electrolyte and catalyst particles;

preparing a solution (c) in which a polymer (a) is dissolved in a solvent (b);

allowing said solution (c) to be contained in said electrode; and

extracting said solvent (b) from the said solution (c) with a non solvent (d) which is insoluble in said polymer (a) and miscible with the solvent (b).